

Remarks/Arguments:

Claims 1-5, 7, 15-23, 25, 27 and 30 remain in this Application. Claims 6, 8-14, 24, 26, 28 and 29 have been withdrawn.

In the May 7, 2003 Office Action, the examiner rejected Claims 1-5, 7, 15-23, 25, 27 and 30 pending in the Application. This Response amends Claims 1-4, 15-18 and 22-23 for consideration. After entering the foregoing amendments, Claims 1-5, 7, 15-23, 25, 27 and 30 remained pending in the Application. Reconsideration is respectfully requested.

Claims 1-5, 7, 15-23, 25, 27 and 30 stand rejected under 35 USC § 103(a) as being unpatentable over Breivogel, US Patent No. 5,554,064 (hereinafter "Breivogel") in view of Rhoades, US Patent No. 5,187,899 (hereinafter "Rhoades"). More specifically, the examiner asserts that Breivogel discloses the claimed invention except for the low amplitude and high frequency vibratory polishing motion set forth in the claims. The examiner further asserts that Rhoades teaches that it is known in the art to utilize high frequency/low amplitude vibrational polishing in combination with the slurry to obtain a high surface finish polish without the loss of resolution or detail. The examiner therefore states that it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized the high frequency/low amplitude vibrational polishing taught by Rhoades since Rhoades states that such a modification would obtain a high surface polish without the loss of resolution or detail (column 3, lines 55-61 in Rhoades). Further, with respect to the range of amplitude and high frequency set forth in the applicants' claims, the examiner asserts that it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized such a range since it has been held that discovering the optimum or workable ranges involves only routine skill in the

art where general conditions of a claim are disclosed in the prior art. Applicants respectfully traverse this rejection.

Breivogel generally discloses a method and apparatus for polishing a thin film formed on a semiconductor substrate. A table covered with a polishing pad is orbited about an axis and a slurry is fed through a plurality of spaced-apart holes formed through the polishing pad to uniformly distribute slurry across the pad during polishing. A substrate is pressed face down against the orbiting pad's surface and rotated to facilitate, along with the slurry, the polishing of the thin film formed on the substrate. Breivogel fails to disclose any vibrational polishing whatsoever.

Rhoades generally discloses high frequency vibrational polishing without substantial loss of fine resolution and detail by employing a tool of a more ultrasonically abradable material than the workpiece as the oscillating driver of a liquid abrasive slurry. The oscillatory vibrations of the tool are imparted to a liquid abrasive slurry disposed between the tool and workpiece which abrades the tool to conform to the configuration of the workpiece and at the same time polishes the configuration of the workpiece (see column 1, lines 23-28). More specifically, the tool is vibrated, "imparting its vibrations to an abrasive slurry disposed in the gap between the tool and workpiece" and "the tool is quickly eroded in such a fashion that it quickly develops a complementary form of the workpiece with a high degree of resolution and detail." (Column 4, lines 2-7). The tool holder is adapted to advance the tool from a retracted position into a working position spaced from the workpiece, and during the working operation, slowly advance the tool or workpiece to maintain a constant gap. The equipment is ordinarily furnished with abrasive slurry handling means so that the slurry can be disposed between the tool and the workpiece with the slurry often being pumped through the gap between the tool and workpiece

to continuously provide fresh, unworn abrasive to the working surface and to flush away eroded material and debris. (Column 5, lines 1-12). Moreover, the Rhoades reference specifically requires the tool to be made of a more abradable material than the workpiece material. For example, if polishing metal workpieces including things such as mild steel to hardened alloys and refractory metals such as titanium and tungsten, the ideal tool material would be a material having a significantly greater degree of ultrasonic abradability such as graphite, glass, quartz and other such materials which have normally been considered ideal workpiece materials but not tool materials. (See column 6, lines 32-40).

Obviousness must be established by consideration of the prior art, as well as the claimed invention, as a whole. The reference must do more than suggest that an innovation "ought to be tried, or is obvious in hindsight, and must itself directly suggest the desirability of a new combination." Richdel Division of Garden America Corp. v. Aqua-Trol Corp., 681 F.Supp., 141 145, 7 USPQ2d 1146, 1149 (E.D. N.Y. 1988). Both the suggestion and the expectation of success must be founded in the prior art, not in the applicant's disclosure. In addition, "in determining whether such a question can fairly be gleaned from the prior art, the full field of the invention must be considered; for the person of ordinary skill is charged with knowledge of the entire body of technological literature, including that which might lead away from the claimed invention." In re Dow Chemical Co. 837 F.2d 469, 473, 5 USPQ2d 1529, 1531 (Fed. Cir. 1988).

Breivogel is specifically directed to polishing a semiconductor's substrate using a polishing pad positioned on a platen that is orbited about an axis. In contrast, Rhoades is directed to polishing the surface of a workpiece utilizing vibrational motion alone. There is no discussion of orbital or rotational polishing in the Rhoades reference. Further, the Rhoades reference, unlike the Breivogel reference, specifically requires that the tool used to impart


vibrational polishing be comprised of a material that is considerably more abradable than the workpiece material. (See column 6, lines 10-13). There is no suggestion anywhere in Breivogel, which imparts orbital polishing, to combine orbital polishing with vibrational polishing. Further, there is no suggestion whatsoever in Rhoades, which imparts vibrational polishing, to combine vibrational polishing with rotational or orbital polishing. Moreover, the requirement in Rhodes that the tool be comprised of a material considerably more abradable than the workpiece material would teach away from combining the polishing method disclosed in Breivogel with the vibrational polishing method disclosed in Rhoades.

Applicants' Claims 1-4, 7, 15-20, 23, 25, 27 and 30 each require both rotational and vibrational polishing. Accordingly, in that there is no suggestion to combine the rotational polishing disclosed in Breivogel with the vibrational polishing disclosed in Rhoades, and actual disclosures in Rhoades that teach away from such a combination, it would not have been obvious to one of ordinary skill in the art to combine Breivogel and Rhoades to arrive at Applicants' claimed invention. Further, Applicants' Claims 5, 7 and 21-22 each require a polishing pad supported on a platen with the platen attached to a mechanical means for causing the pad to orbit about an axis offset from the central axis where (1) the orbital axis is offset from the central axis of the pad from about 0.05 to about 2.0 mm, or (2) the axes are offset such that the platen vibrates at a frequency in the range of about 2,000 to about 10,000 rpm. Breivogel fails to discuss vibrational polishing at all. Moreover, Rhoades, although it discloses vibrational polishing, fails to disclose offsetting the orbital axis from the central axis of the pad to cause vibratory motion. Therefore, it could not have been obvious to one of ordinary skill in the art to combine Breivogel with Rhoades, or even to look at Rhoades alone, to arrive at Applicants' claims.

In view of the foregoing, Applicant respectfully submits that all of the pending claims fully comply with 35 USC § 112 and are allowable over the prior art of record. Reconsideration of the Application and allowance of all pending claims is earnestly solicited. Should the examiner wish to discuss any of the above in greater detail or deem that further amendment should be made to improve the form of the claims, then the examiner is invited to telephone the undersigned at the examiner's convenience.

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Respectfully submitted,

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